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# "OUR WATER SUPPLY

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A DISCUSSION FOR AND AGAINST  
THE  
FITNESS OF THAMES AND RIVER WATER  
FOR  
DOMESTIC USE.

*Reprinted from* THE SURREY COMET.



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## INTRODUCTORY.

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At the present juncture, the facts and recitals in the following pages, on the fitness of Thames and river water for domestic use, are worthy the close attention of the inhabitants of London. In 1849, the then Chairman of two London water companies—the Grand Junction and the Southwark and Vauxhall—who, whilst he was using his influence to oppose the establishment of new and competing companies then seeking powers from Parliament to supply purer river, and pure softened spring water to London, was at the same time publicly advocating the transferring the duty of furnishing London with water from companies to some public authority, with the avowed object of selling the works of the companies aforesaid, at a sum “not only just, but liberal;”—to further this object, stated in a pamphlet dated 15th December, 1849, that he did not hesitate, on the authority of some well-known analytical chemists of the day, to avow—“*Of this I am certain that water, taken either at Kew or Barnes at any time of tide, or at Battersea during ebb, and properly filtered, cannot be shown, either by sight, by taste, by smell, or by the most delicate analysis, to be*

*inferior in any respect—while, in some respects it will be superior—to water taken at Henley, or Maple-Durham, or Oxford.”*

By the political influence of the Chairman, who, at the time, was Member for the Tower Hamlets, aided by that of similarly interested parties, the application to Parliament for powers to construct intended works to afford a less contaminated water from the Thames, at Henley and Maple-Durham, and the thrice-repeated like applications in 1851, 1852, and 1853, to afford a pure and cheap supply of softened spring water from the chalk strata near Watford to a portion of London then wholly supplied from the Thames taken as low down as Kew and Battersea, were, on the second reading in 1853, frustrated, notwithstanding that 40,000 consumers of water petitioned Parliament in favour of establishing the company that sought powers to afford a competing supply of softened spring water, and that the Government Commission of 1851 had previously reported most strongly in favour of London being supplied with such spring water.

In spite of certificates of purity from the companies' chemists, it is a matter of history that, in 1853-4, as many as three thousand four hundred and seventy-six tenants of the Southwark and Vauxhall Company—a company which then distributed water from the Thames at Battersea—were officially reported to have died of cholera; and, out of this number, Mr. John Simon, the Medical Officer of the then General

Board of Health, reported to the President, on the 13th of May, 1856, "that, of the 3,476 (three thousand four hundred and seventy-six) persons, tenants of the Southwark and Vauxhall Company, who died of cholera in 1853-4, two-thirds would have escaped if their water supply had been like their neighbours; and that, of the much larger number—tenants of both the Lambeth and the Southwark and Vauxhall companies—who died in 1848-9, also two-thirds would have escaped, if the Metropolis Water Act of 1852 had but been enacted a few years earlier."

The Act of Parliament referred to was passed to prevent the companies taking water, after August, 1855, for the supply of London, from the Thames below Teddington Lock. Instead of the companies, however, resorting to those enormous supplies of pure water so readily and so cheaply to be obtained at a high level from the chalk strata surrounding London, as was strongly recommended at the time by the Government Commission, consisting of the late eminent Professors Graham and Miller, and Professor Hoffman, the companies insisted upon still resorting to the river above Teddington Lock, notwithstanding it had been demonstrated before the Select Committee of the House of Commons, in 1852, by irrefutable evidence given by the promoters of the Bill of the London (Watford) Spring-water Company, that the water above Teddington Lock, though less contaminated than below the lock, was still too impure for domestic use. Yet, at the present time, as will be

seen by the following correspondence, men well-informed on other subjects are to be found who, trusting to the statements of certain analytical chemists, assert that the water above Teddington Lock is quite innoxious, as, in 1849, the Chairman of the two water companies above referred to declared it to be below the lock at Kew and Battersea.

For instance, Dr. Meymott Tidy, M.B., M.S., F.C.S., unhesitatingly states, in 1878, in a report addressed to the Society of Medical Officers of Health, "Although I have most diligently considered and compared the death-rates, and also, as far as possible, the causes of death, of different parts of the metropolis, supplied by the Thames water, the Lea water, and the water from the chalk wells of the Kent Company respectively, I have failed to discover any differences worth noting in the death-rates, or any evidence whatsoever that any special class of disease has been prevalent from drinking waters of the Thames and Lea, or absent from the use of the chalk water." No doubt, on similar authority (?), Sir Edmund Beckett, Bart., Q.C., leader of the Parliamentary Bar, and the retained advocate of the London water companies, did not hesitate to write to the *Times* a letter, published on the 10th of January, 1876, to the purport that those who complain of the quality of Thames water "have never traced the smallest degree of illness in London to the drinking of the water now supplied from either the Thames or the Lea."

The same wrongheadedness that characterises

the avowal of the chairman of the two water companies in 1849 is found in the avowal of the learned counsel for the companies in 1876. In the weekly return of births and deaths in London and twenty-two other large towns of the United Kingdom, published by authority of the Registrar-General, for week ending Saturday, July 20th, 1878, the following revelations will be found:—"In London, the high mortality of the week is due to diarrhœa, which becomes fatal in London when the temperature of the Thames rises much above 60 deg. Thus, the Thames temperature, which had been 60 deg., rose in the last week of June to 65 deg.; in the three following weeks, it was 68 deg., 66 deg., and 67 deg. The weekly deaths from diarrhœa and simple cholera, which had been 23, rose to 78, 156, 256, and 349 in the corresponding weeks. The deaths from diarrhœa are differently distributed in the fields of the water companies. Thus, the deaths in the last four weeks were 786 in the districts supplied with Thames and Lea waters, whereas the deaths in the districts supplied with water drawn from the chalk by the Kent Company were 19. Out of the same population, the deaths in the former were to the deaths in the latter as 3 to 1."

In the issue for the following week, ending July 27th, 1878, will be found—"The deaths referred to diarrhœa and simple cholera, which in the five preceding weeks had rapidly increased from 22 to 349, further rose last week to 457, of which 336 were of infants under one year of age, and 99 of children aged

between one and five years." \* \* \* \* \*

‘During the past five weeks, the annual death-rate from diarrhœa within the area supplied by the Kent Water Company from deep wells in the chalk, has been equal to 1·7 per 1000; whereas, in the rest of the metropolis supplied by the other companies with water from the River Thames and Lea, the diarrhœa rate averaged 3·7 per 1000.’

Notwithstanding these deplorable and frightful facts, pointed out by so competent and independent an authority as the Registrar-General, and without any consideration for the desires or wishes of the great mass of the inhabitants of London, the water-consumers—who for many years past have suffered illness and premature death from being, against their will, obliged to drink polluted Thames and Lea river water—and not only so, but, as years passed on since 1854, have had to keep paying a higher and higher monopoly price—are now threatened with a Government project to compel them to buy up for a monstrous sum, and to become the proprietors of, the existing works, whose chief value consists in the close monopoly the directors have contrived to extort or to obtain by strategy from the Legislature.

The total expenditure of the eight water companies, from their establishment up to the 30th of September, 1878, is seen in a return made by an Order of the Honourable the House of Commons in the past year; in round figures, it amounts to twelve millions one hundred thousand pounds. Competent authorities

state that, including the sum to be paid to the companies for forced (?) sale, the cost of the purchase to the ratepayers will exceed twenty-eight millions.

Should the intended purchase of these effete works take place, neither the quality of the water as now supplied, nor the mode of supply will thereby in any degree be bettered. Neither is it likely that the working expenses can be appreciably lessened by any new body that may be appointed to perform the functions of the companies, notwithstanding the totally unreliable and loudly-asserted statements to the contrary. In order to improve the mode of distribution, and to get rid of the necessity of still supplying to London the enormous volume of Thames and Lea water that the Registrar-General has reported in certain warm seasons to be infected, another large outlay, probably five or six millions, will be needed; so that, under the proposed arrangement, if the quality is to be bettered, the total cost to the consumers of water—*i.e.*, the ratepayers—is not likely to be less than from 33 to 34 million pounds sterling.

At the present time, competing works, of the best design and construction, including entirely new distributing mains and service-pipes, for the supply of all London and the suburbs served by the existing companies, could be constructed for ten millions. For this sum a constant supply, at high pressure, of pure, softened spring water, derived from unpolluted subterranean sources could be had. Will the ratepayers and water consumers of London be satisfied to saddle

themselves, and their posterity, with the payment of 33 or 34, or more, millions, when their object can be better attained at an outlay of ten millions, or less? If not, they must bestir themselves betimes, for it is confidently stated that a Government department and the eight companies that supply London have made a compact, the latter to sell at a monopoly price, the other to force the ratepayers to purchase the existing obsolete works, and thus, for ever, saddle the ratepayers with a worse than useless outlay of 24 millions, and, in consequence, debar competing companies from ever being able to furnish London with supplies of pure, softened spring water, on a better and more efficient system, at their own risk, at one-half the charges now enforced by all the present companies for their hard, or hard and impure water, by far the larger volume of which is river water that has been unavoidably mixed with much liquid fœcal and other noxious matter, and which must, as the population increases, be ever more and more contaminated. Even now, as shown by the able and impartial returns of the Registrar-General, this water is infected in hot seasons—the very time when drinking water is in most request by young and old.

Many other important characteristics of river and softened spring water will be found discussed in the following letters.

London, February 5th, 1880.

## “OUR WATER SUPPLY.”

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*From THE SURREY COMET, Saturday, February 22nd, 1879.*

SIR,—Inasmuch as the quality of the Thames water has caused some uneasiness to the minds of those deriving their supply therefrom, it may be interesting to your numerous readers, and especially so to the inhabitants of Wimbledon (who are contemplating a change of water supply), to learn that the quantity and quality of water supplied to London and the various suburbs during 1878 forms the subject of an annual report to the Society of Medical Officers of Health, by Dr. Meymott Tidy, F.C.S.

The report shows that the maximum quantity of water was supplied in July, when it was 148,360,908 gallons. The average supply was 129,666,196 gallons, or no less than 36 gallons per head per day.

A great deal of waste is due to the intermittent system of supply, and, although 122,242 of the 552,955 houses supplied have now a constant supply, it will, at the present rate of alteration, take a long time to make the constant system general.

Dr. Tidy again directs attention to the harmless nature of the inorganic constituents of the several waters, and says that they are wholesome, and essential to health, though Dr. Frankland continues to call them solid *impurities*.

With respect to inorganic impurities, the following is given

as the order of purity of the water supplied by the five companies deriving their supply from the Thames:—Chelsea, Lambeth, Southwark and Vauxhall, Grand Junction, and the West Middlesex.

The water supplied, he says, is in every respect wholesome, and well fitted for a town supply.

In concluding his report, Dr. Tidy says:—"Of the water supplied to London, therefore, during 1878, I can only re-echo the views expressed by a Select Committee of the House of Commons in 1867, that it is satisfactory both as regards quantity and quality."

That the quality of the Thames water will be further vastly improved, is shown by the extensive interception of the sewage from the towns of Abingdon, Oxford, Reading, Windsor, and many other towns formerly draining directly into the river.

In the face of this report, the Wimbledon authorities should defer any further action in attempting to acquire the rights and privileges of the Lambeth Water Company as regards our district, and give up the costly idea of proceeding with their proposed arbitration, for which purpose they contemplate a large expenditure prior to establishing a supply from the chalk formation.

I am, sir, yours faithfully,

WM. F. ROWELL, C.E.

Wimbledon, Feb. 18th, 1879.

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*From THE SURREY COMET, March 1st, 1879.*

SIR,—Is the Thames water, after it has been filtered and delivered into consumers' dwellings for household consumption,

of the innocent quality that Dr. Meymott Tidy, as quoted by your correspondent in last week's issue, would have us believe?

Or can Dr. Meymott Tidy himself be so innocent as to believe that Thames water, as supplied to consumers by the Southwark and Vauxhall and the Lambeth Water Companies, "is in every respect wholesome, and well fitted for a town supply?"

All would agree, your correspondent and Dr. Meymott Tidy, perhaps, excepted, that water supplied to a town should be:

1. Wholesome, free from animalcules or larger organisms, animal or vegetable, living or dead, and at no season of the year, nor in seasons of epidemics, liable to propagate disease, or cause the death of those who drink it, or who use it to dilute milk or other beverages.

2. That it should contain but little mineral matter in solution, be soft, and pleasant to use with soap, and of a quality such as would not dissolve lead, or form a deposit or fur when boiled.

3. That it should at all seasons be clear and bright, and agreeable to the eye when seen in large bulk, as in a bath; and that it should be refreshing to the taste.

4. That it should be well aerated, of a useful uniform normal temperature, neither unduly warm in summer, or unduly cold in winter, so as, in the last case, not to be liable to be frozen in the service-pipes.

The Thames water, after being filtered, as delivered into consumers' dwellings, does not possess even one of the above-named characteristics.

1. Such Thames water is found to contain, diffused throughout its bulk, numerous species of living organisms, animal and vegetable, as shown by the microscopical analyses of Dr. Hassall, F.L.S., the late Dr. Lankester, and others.

Accordingly, in the weekly returns of the Registrar-General

for the week ending July 20th last year, will be found :

“The high mortality of the week is due to diarrhœa, which becomes fatal in London when the temperature of the Thames rises much above 60 degrees. Thus, the Thames temperature, which had been 60 degrees, rose, in the last week of June, to 65 degrees; in the three following weeks, it was 68, 66, and 67 degrees Fahr. The weekly deaths from diarrhœa and simple cholera, which had been 23, rose to 78, 156, 256, and 349 in the corresponding weeks. The deaths from diarrhœa are differently distributed in the fields of the water companies; thus, the deaths in the last four weeks were 786 in the district supplied with Thames and Lea waters, whereas the deaths in the district supplied with water drawn from the chalk by the Kent Company were 19. Out of the same population, the deaths in the former were to the deaths in the latter as 3 to 1.”

2. Such water is hard, varying from 12 to 15 degrees of hardness by Clark’s test, thus chapping the skin when used with soap, more especially in cold weather, and forming a deposit in kettles and boilers when boiled.

3. Such water, when seen in large bulk, as in a bath, is opaque, unpleasant to the sight, and far from refreshing to the taste.

4. Such water, at its source, in summer, is as high in temperature as 68 to 70 degrees Fahr., and in winter as low as 36 to 34 degrees Fahr., and thus readily frozen in, and often bursting the pipes in consumers’ dwellings, as most of your readers, Mr. Editor, can, unfortunately, testify.

About a million souls, besides numerous living beings, such as cattle, &c., reside on the drainage-ground of the River Thames above Hampton, whence the Southwark and Vauxhall, and Lambeth Water Companies derive their supplies, and the excrements of healthy and diseased men and animals, leaves, and other impurities, find their way into the river and con-

contaminate the water. This, and especially in seasons of epidemics, causes not only illness, but fatal illness, to many of those who drink it.

In 1849, the then chairman of the Southwark and Vauxhall Company stated, in a pamphlet published by him, on the authority of certain eminent analytical chemists: "Of this I am certain, that water taken either at Kew or Barnes at any time of the tide, or at Battersea during ebb, and properly filtered, cannot be shown, either by sight, by taste, by smell, or by the most delicate analysis, to be inferior in any respect; while, in some respects, it will be superior to water taken at Henley, or Maple Durham, or Oxford."

Notwithstanding this positive statement, made on the faith of certain analytical chemists, of the late chairman of the Southwark and Vauxhall Water Company, which company at the time drew its supply of water from the Thames at Battersea, the then Medical Officer of the General Board of Health, Dr. Simon, soon after showed in a report, printed by order of Parliament, that during the cholera epidemic of London, in 1854, "In the 39,726 houses supplied by the Southwark and Vauxhall Company, comprising a population of about 268,171 persons, there occurred 3,476 deaths, being at the rate of 130 *to every* 10,000 *living*;" while, "in the 24,854 houses supplied by the Lambeth Company" (which had changed its source to the Thames at Surbiton), "comprising a population of about 166,906 persons, there occurred 611 cholera deaths, being at the rate of *only* 37 *to every* 10,000 *living*."

Since 1854, the population residing on the water-shed of the Thames above Teddington have greatly increased in numbers, and must continue to increase.

Your correspondent states that the sewage from the towns of Abingdon, Oxford, Reading, Windsor, formerly draining

directly into the river, is now intercepted; but such statement is quite incapable of proof; the liquid sewage *now* all finds its way into the river as before, although some of it, is no doubt, treated in different manners with the view of purifying it before it reaches the river; but what treatment *will* kill the germs, or virus, of typhoid, cholera, and other contagious diseases, or render infected water pure?

The warning given in the Registrar-General's report, herein-before quoted, shows danger a-head; and, as uncontaminated and soft water can be got for Wimbledon, is it any wonder, Mr. Editor, that the inhabitants, at two public meetings—one held on the 31st January, 1877, and the other held on June 30th, 1878—solely to consider the question, have unanimously directed their Local Board to take the necessary steps to obtain such a supply?

I am, sir, your obedient servant,

AN INHABITANT OF WIMBLEDON.

Feb. 25th, 1879.

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*From THE SURREY COMET, March 8th, 1879.*

SIR,—The letters of your correspondents, “An Inhabitant of Wimbledon,” and “A Surbiton Resident,” are so alarming, that I have to ask space to state the facts about the water we drink.

1. As to the purity of the water, your Wimbledon correspondent quotes Dr. Hassall's and Dr. Lankester's opinions about the condition of the water years ago; but what have those to do with the present time? Dr. Frankland, the great apostle of chalk water, speaks thus in his report to the Local Government

Board (*vide* Local Government Board's Report, 1876, page 125), dated 30th January, 1877 :—" Since the year 1868, when I first instituted these observations, the filtration of the river water has undergone great and continued improvement. Thus, during the year 1868, seven samples of water were very turbid when drawn from the mains. In 1869, six samples were very turbid; four in each of the years 1870 and 1871; in 1872, only one sample was very turbid; in 1873, none; in 1874, one company's water reached that degree of muddiness on two occasions; but since that date no sample has been drawn in a very turbid condition from any main in the metropolis." Then, as to the living organisms, he says :—" When examined by the microscope, the sediment deposited by turbid water on standing is almost always found to contain numbers of living and moving organisms."

You, sir, allude to the last report of the water examiner to the Local Government Board, and you quote Dr. Frankland's remarks therein contained, as to the water being much polluted by organic matter, and so forth. Dr. Frankland always uses strong terms; let us look at his facts. Confining myself to the waters named by your correspondent, I find that the total organic matter contained therein was, in the Lambeth Company,  $\cdot 277$  in 100,000 parts, equal to  $\cdot 1939$  of a grain per gallon, which is equal to one part of organic impurity in 361,000 parts of the water; the Southwark and Vauxhall,  $\cdot 309$  per 100,000 parts, or  $\cdot 2163$  of a grain per gallon, equal to one part of impurity in 323,000 parts of water; while the Kent contained  $\cdot 101$  per 100,000 or  $\cdot 0707$  of a grain per gallon, equal to one part of impurity in 990,000 parts of water. If your correspondent thinks that it will make any difference to the most thirsty soul whether he drinks 21·100ths or 7·100ths of a grain, or 70,000th part in every gallon of water he consumes (a gallon contains 70,000 grains), probably your readers will consider

that it is a matter of no moment, especially if they realise that it would take half a lifetime to consume about an ounce of the organic impurity.

I have never seen the Registrar-General's report referred to, but I should say that dirty cisterns had more to do with the matter than anything else.

Chalk water is very good, but it is not altogether, sometimes, as pure as it might be; for instance, Mr. Bateman, C.E., in his report to the Croydon Board of Health, dated 19th December, 1877, stated, "Thirdly, that in adjacent districts, similar in their general circumstances, to the one supplied with water from the Lambeth Company and the other with water from Croydon, the epidemic fever of 1875 only prevailed in the district supplied with Croydon water."

Then, at the present time, there is an epidemic form of typhoid fever prevailing in Reigate, attributable to the pollution of the chalk water supplied to the town by the Caterham Water-works Company.

Dr. Frankland used to have a table headed "previous sewage contamination," but he has dropped it for the last two years. That always showed that the Kent water contained nearly twice as much of the traces of previous sewage contamination (whatever they were) as the Thames companies, not that I attach much importance to this matter.

So much for purity.

2. Your correspondent complains of the hardness of Thames water. If you refer to the last report of the water examiner, you will see that the total hardness of the Lambeth water was 23·6, Southwark and Vauxhall was 22·4, while that of the Kent was 29·4; so that the chalk was 25 per cent. harder than that of the Thames.

3. Your readers who are consumers of the Thames companies' water can judge for themselves whether there is any

ground for its alleged turbidity. I never found it opaque, but bright and clear. Even Dr. Frankland says it is, when seen through a stratum 2 ft. deep, "clear," but "pale yellow." Water experts are nice in their discrimination of colour. I observe, for instance, Dr. Mills states that the Glasgow water was "light brown in colour."

4. Now, as to temperature. If the public obtain pure drinking water direct from the companies' mains, as they ought with constant supply, it is pretty much the same temperature, whether its source is the companies' covered reservoirs or the natural reservoirs of the chalk. Surely, the inhabitant of Wimbledon is not such a simpleton as to suppose that the chalk water would not freeze in the consumers' pipes as easily as the Thames water. A night's hard frost would leave both in the same condition in the morning, even if one were boiling to start with.

I have dealt with all your correspondent's allegations as to matters of fact; it is not necessary to follow him into the regions of fancy and speculation. Is he a second Rip Van Winkle, that he attempts to discuss what was written in a pamphlet 30 years ago? He could refer to Parliamentary Papers 353, of 1876, and 48, of 1877 (Reports of Thames Conservators), and learn the exact state of affairs as to the sewerage of towns on the upper Thames if he wishes for information.

As to the supply of Wimbledon. The Lambeth Company have Parliamentary rights over the district, which they have stated they are quite willing to exercise when called upon to do so. The Wimbledon Local Board would have to show, if they sought powers to obtain a separate supply for themselves, that the Lambeth water was derived from an impure source, instead of which it is from one approved by the Legislature, and, as I have, I think, clearly shown, it is of extremely good quality.

I, therefore, hope the ratepayers' money will not be wasted in any futile attempts on the part of the Local Board to obtain an Act to supply Wimbledon with water.

I am, sir, yours faithfully,

WM. F. ROWELL, C.E.

*From THE SURREY COMET, March 15th, 1879.*

SIR,—Your correspondent, Mr. Rowell, in last week's issue, asks "what has the condition of the Thames water years ago to do with the present time? What difference does it make to a thirsty soul whether he drinks two-tenths of a grain of organic matter in a gallon as it exists in Thames water, or seven one-hundredths of a grain per gallon as it exists in subterranean water from the chalk, as supplied by the Kent Company?"

Let us see. On the 31st of January, 1857, Dr. Hassall, in a report presented to both Houses of Parliament by command of her Majesty, states, as the results of his microscopical examination of samples of water obtained *from the service-pipes* of the water companies then deriving their supplies from the Thames above Teddington-lock, that, as respects the Southwark and Vauxhall Company, "The water was *opalescent*, and of a somewhat dirty appearance when collected . . . and contained living organic productions, consisting of *Infusoriæ*, *Desmidiæ*, *Diatomaceæ*, and Fungi . . . and these organic productions so abounded in it, that a whole volume might have been written illustrative of their natural history." Much to the same purport was Dr. Hassall's report on the water supplied by the Lambeth Company, and, towards the end of his report,

Dr. Hassall states:—"It follows that the metropolis is still supplied with water containing considerable numbers of living vegetable and animal productions, and *which are not present* in the purer waters, as, for example, that supplied (from the chalk) by the Plumstead, Woolwich, and Charlton Company."

No doubt, 22 years have elapsed since this report was written, but, on May the 12th, 1875, the well-known eminent surgeon and microscopist, Mr. Jabez Hogg, stated, in a paper he read before the Society of Arts, that "almost every gallon of river water distributed to London contains a quantity of spores, seeds, or ova of vegetable or animal organisms, and, if a bottle of water is allowed to stand by for a short time, a sediment is thrown down in which a number of creatures will be discovered by the microscope. Such water is undoubtedly unwholesome and dangerous, whether it contains the actual carriers of disease or not. If it contains the elements of disease, it is doubly dangerous; if it does not contain matter which may cause disease, it is still dangerous, because it is the general experience of those who study health and disease that the drinking of impure water predisposes drinkers to many disorders and diseases, which, although they may not be actually produced by the water, enables certain diseases to seize upon its victims, because such persons are what is termed 'predisposed,' that is, deteriorated in health by this impure water." We all eat and drink organic matter in the shape of bread, fresh meat, soup, &c., and in these conditions no one doubts its wholesomeness and fitness for nourishing the human system. The wholesomeness or unwholesomeness of organic matter depends solely upon the *quality* of the organic matter we eat and drink. Subterranean supplies of water derived from uncontaminated chalk and some other porous strata, as Dr. Hassall, Dr. Redfern, Mr. Jabez Hogg, and many other competent men of science have testified, contains no living organisms, or the

germs or virus of fever, cholera, &c., while River Thames water, at certain times and seasons, has been proved to abound in such impurities. It is not, then, the quantity, but the quality of the organic matter contained in water that renders it wholesome or unwholesome. Even as respects quantity, however, it must be remembered, when a chemist states that water contains only about two grains of organic matter per gallon, that this is the mere weight of the charred organic matter. Now, living organisms, animal or vegetable, when charred, weigh less than one-sixth of the organisms when living, so that two grains of the chemist have to be multiplied by six, making 12 grains as the actual weight of the organic matter and living organisms contained in such water.

Again, it must be remembered that living organisms, in water containing fœcal and other impure matter, find a suitable nidus wherein to germinate, and live, and increase and multiply, more especially when the water is comparatively warm, as in summer and autumn; and it is well known, as stated by Mr. Jabez Hogg in the paper before alluded to, that "under favourable circumstances, a single bacterium, such as abound in Thames water, produces 16,777,220 individuals every 24 hours."

Is it any wonder, then, that the Registrar-General reports the weekly *deaths* from diarrhœa were found to increase in four warm weeks of June and July of last year from 78 to 349?

Allowing that the filtration of Thames water has undergone improvement, what then? Is the water any less unwholesome because it may be clearer? Every one knows that the liquid evacuations of both men and animals are often clear, and can be readily passed through a water-logged stratum of coarse sand, as practised by the water companies; but is the liquid any the less urine, after being so passed through a stratum of water-logged sand, than before? When urine and water are passed together through the sand, is urine in any degree separated from

the water? No doubt, faded blossoms, fallen leaves, farmyard manure, and the more solid insoluble portions of human faeces, may be detained on or near the surface of the sand filter. The organic matter thus detained, however—more especially in warm seasons—becomes more or less rotten, and in this state is readily taken in solution by the water passing through it, and forms an excellent *nidus* for the breeding and growth of the numerous species and incredible numbers of animaleules, both vegetable and animal, that abound in river and surface water.

Many of these animaleules are so infinitesimally small, that young and old, with their larvæ, together with the virus or germs of specific diseases, such as cholera and scarlet fever, pass readily through a stratum of sand with the water; and thus, especially in hot weather and in seasons of epidemics, enter the human system, often multiplying when there, and thus causing illness, and frequently premature death. As stated by Dr. James Henry Bennet, "It is now all but universally admitted that many of the diseases called zymotic—which comprises epidemic, endemic, and contagious diseases—owe their origin to germs introduced into the system from without. For these germs, however, to take root—as it were, to develop—the animal organisation must be prepared for their reception. The most efficacious preparation, no doubt, is a low state of vitality from defective nutrition. . . . If the nutritive functions are sound, and the organisation is healthy, it resists their presence and action. They do not find in it a suitable *nidus* wherein to germinate, so they are destroyed, or expelled." But who can *always* keep themselves or their families in a sound and healthy state? and why should water infected with germs or the virus of specific disease be compelled to be used for domestic purposes when water free from them can be obtained?

Anything can be spoiled, and, no doubt, water from chalk

strata may be spoiled, or contaminated, as anything else may be; but, at its uncontaminated source, the water is wholesome, and by proper care can, and no doubt will, be so delivered to Wimbledon.

Your correspondent states that subterranean water from the chalk strata, in its normal condition, is harder than River Thames water; but, while making this statement, *he* cannot but know that the intention is to soften the water to be supplied to Wimbledon by Clark's well-known and largely-adopted process, which would render the water only  $3\frac{1}{2}$  degrees of hardness, or only one-fourth the hardness of Thames water; so that his remarks on this head can only tend, and one would suppose could only be intended, to mislead the unwary.

The same may be said with respect to your correspondent's remarks as to the freezing of the Thames water, whose normal temperature in the river in cold weather is 34 degrees Fahr., while the normal temperature of chalk water at its source is 50 degrees Fahr., or 14 degrees warmer. Owing to this—while, in winter, chalk water can be, and from properly-constructed works is, delivered into consumers' dwellings situate 10 to 12 miles distant, at 44 degrees, or only 6 degrees lower than its normal temperature—river water, in cold weather, is delivered into dwellings just upon the point of freezing, and, in consequence, in well-designed and constructed works, while a frozen pipe, or a pipe burst from the action of frost, is hardly known, on the other hand, frozen and burst pipes supplied from the river in certain cold seasons are almost universal.

As to what companies have or have not legal rights to supply water to Wimbledon, competent lawyers are the proper persons to deal with such questions, and I cannot ask space of you, Mr. Editor, to discuss them with your correspondent.

I am, sir, your obedient servant,

AN INHABITANT OF WIMBLEDON.

Wimbledon, March 11th, 1879.

*From THE SURREY COMET, March 22nd, 1879.*

SIR,—It is needless to occupy your space by considering what Dr. Hassall said nearly a quarter of a century ago, or by discussing the germ theory of disease with “An Inhabitant of Wimbledon.”

That “doctors differ” is proverbial, and, if he brings forward the late Dr. Hassall, Mr. Jabez Hogg, and Dr. Bennet as his authorities, I could refer him to the late Dr. Letheby, Dr. Odling, and Dr. Tidy for opinions directly opposite. But I preferred to quote from the published facts of Dr. Frankland, the most pronounced of all advocates of chalk water, to show that the water we drink was extremely good. Your correspondent, however, tries to distort these facts, and says that, if you compare these analyses of Dr. Frankland, showing organic matter in the Kent water and the Thames water, you must multiply the organic matter in the latter by six, on account of the living organisms. This is ingenious, but most disingenuous, because even Dr. Frankland says that living organisms are only discovered by the microscope in the sediment deposited by turbid water on standing—for how long, he does not say—and I quoted Dr. Frankland in my last letter as to the rare occasion on which turbid water is supplied.

Your correspondent raises no new point, and what object can be gained by his troubling your readers with vamped up reports, 22 years old, I fail to perceive. All the chemical questions have been raised over and over again, and when they are thoroughly investigated they are found to be as impalpable as germs. A great deal of nonsense always will be talked about the water supply by doctrinaires, alarmists, projectors, and the like; but, when the matter is looked at and investigated from a common-sense point of view, and the truth

elicited by a competent tribunal, the purity of the present sources of supply is established and reaffirmed.

The last occasion when the question was thoroughly gone into was in 1869, by the Royal Commission presided over by the Duke of Richmond, from whose report I will quote the following extracts:—"That there is no evidence to lead us to believe that the water now supplied by the London companies is not generally good and wholesome."

Speaking of the alarming statements in the published chemical analyses, such as your correspondent delights to dwell on, the report says:—"And, further, we cannot but consider it unphilosophical when, in addition to treating as 'impurities' substances perfectly harmless even in much larger quantities, the minute quantities present in a gallon, or any other small measure of water, are multiplied by taking masses of water, such as the individual never has to deal with, and given to the public in figures so large as to tend to cause misconception, and perhaps unnecessary alarm in the minds of those not conversant with the conditions of the case. It would be as just to speak of the small proportion of carbonic acid present in the atmosphere, equally in populous cities and the Alps, as an impurity, and to startle those unacquainted with the subject by giving, in some large figures, the total quantity of that gas present in the atmosphere of London."

As to the question of hardness, your correspondent has not controverted what I said by his assertions. Chalk-water, I am free to admit, can be softened by Clark's process, which is almost necessary; whereas, it is not so important in river water, which is about 33 per cent. softer. But the same process can be equally applied to river water.

The assertions as to the temperature of the different waters affecting the bursting of service-pipes are contrary to common sense. I have no doubt there are as many burst pipes in the

Kent Company's district as any of the other London companies.

This correspondence began with regard to the Wimbledon water supply, in which many of your readers, as ratepayers, have an interest in preventing the Local Board attempting to waste money by endeavouring to obtain powers to get a supply from the chalk. I have shown that there are no grounds, in the quality of the water at present supplied, for such an attempt.

I will not trespass further on your space by any more letters.

I am, sir, yours faithfully,

WM. F. ROWELL, C.E.

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*From THE SURREY COMET, March 29th, 1879.*

SIR,—Your correspondent, Mr. Rowell, would appear to be but imperfectly acquainted with the facts relating to the water supply of the metropolis, and his remarks, if left uncorrected, might leave erroneous impressions on the minds of such of your readers as have not had occasion to make themselves specially acquainted with the subject. His statement, "That the last occasion when the question was thoroughly gone into was in 1869, by the Royal Commission presided over by the Duke of Richmond," is quite erroneous; the fact is, that the last occasion when the results of such an inquiry was made public is contained in the sixth report of the Commissioners appointed to inquire into "the best means of preventing the pollution of rivers," and entitled "Domestic Water Supply of Great Britain," published, and presented to both Houses of Parliament by command of her Majesty, in the middle of the year 1874. In

this report, containing more than 500 pages, with respect to the quality of the Metropolitan Water Supply which is derived from the Thames, may be found, at page 428 :—

1. “The Thames, above the intake of the respective water companies, receives the sewage from a large number of towns and other inhabited places, the washings of a large area of highly cultivated land, and filthy discharges from many industrial processes and manufactures.

2. “The river is used for bathing, for the washing of sheep and cattle, and of dirty linen ; and the putrid carcasses of animals float upon its service. It is the common water-way for a large amount of polluting matter, much of which is, at times, dangerous to the health of persons who use even filtered water for dietetic purposes.

3. “In time of flood, a large proportion, both of the suspended *and dissolved filth*, is conveyed down to the intake of the metropolitan water companies, and in ordinary weather, a considerable proportion of the soluble organic matter of sewage, discharged into the river and its tributaries, likewise makes its way down to the works of the water companies, *and is still present in the water distributed by them in London*.

4. “The water is, nevertheless, when efficiently filtered, free from any offensive taste or odour.

5. “Notwithstanding the application of partial remedies for sewage pollution at Banbury, Eton, and Windsor, and the greater care exercised by most of the companies in the storage and filtration of the water, the organic pollution contained in the Thames water delivered in London, though subject to fluctuation from the greater or less prevalence of floods, *does not diminish*.

6. “There is no hope of this disgusting state of the river being so far remedied as to prevent the admixture of animal and other offensive matters with the filtered Thames water as delivered in the metropolis.

7. "The temperature of the water drawn from the companies' mains is liable to excessive fluctuation, being near the freezing point in winter, and so high in summer as to render the water rapid and unpalatable.

8. "We, therefore, recommend *that the Thames should, as early as possible, be abandoned as a source of water for domestic use, and that the sanction of your Majesty's Government be, in future, withheld from all schemes involving the expenditure of more capital for the supply of Thames water to London.*

With respect to the supply of the metropolis with spring and deep-well water from the chalk, at page 430 of same report may be found—

1. "Abundance of spring and deep-well water of excellent quality can be procured in the basin of the Thames, and within a moderate distance of London; and we are of opinion that the metropolis and its suburbs should be supplied, on the constant system, *exclusively* with this palatable and wholesome water.

2. "We recommend that this water should, before delivery to consumers, be softened with lime.

3. "The introduction of this new supply of wholesome, palatable, and soft water will render necessary either the throwing open of the metropolitan water supply to the competition of new private companies, or to the transference of the control of that supply to a responsible public body, invested with the necessary powers for the purchase of the existing works and the construction of such other works as may be required for the acquisition and supply of so much spring and deep-well water as may be necessary to replace the river water now delivered in London and its suburbs. Of these two alternative measures, we give strong preference to the last."

This, the last official report on the whole question of the supply of water to the metropolis, confirms all that many previous reports have made known in condemnation of the quality of

the Thames water as supplied into consumers' dwellings, and also confirms what previous official reports have put forward in favour of supplying all London with softened spring water derived from the chalk, as well as the monthly statements made public in the Registrar-General's returns, copies of which are frequently to be seen in your pages. The time of the public is necessarily so taken with the performance of their own especial duties, that the bad effects, ill-health, and deaths that accrue from using impure water are, unfortunately, even yet feebly understood; every day that passes, however, tends to enlighten the great mass of the people. An eminent medical man wrote me a few days since, "The argument against Thames water is, I should think, quite conclusive, except amongst those people who are determined to remain of the same opinion still. . . . I fear it will take a great deal of writing to convince these people—dirty people, I was about to say—of the danger and folly of *drinking in a circle*."

The danger and folly of thus drinking is fully acknowledged among those who have studied the subject, and this acknowledgment has already yielded good fruits. A large portion of the metropolis, and the suburban districts around, besides numerous provincial places, and towns, and cities, have advantageously of late years discarded the use of river water, and resorted to the ample and uncontaminated supplies to be obtained from the chalk, and other porous and suitable geological formations. It is to the diffusion of sound knowledge among the many that most improvements are due, and I beg to thank you, Mr. Editor, for devoting so much space in your journal for the discussion of a subject on which your readers are so much interested in obtaining reliable information.

I am, sir, yours obediently,

AN INHABITANT OF WIMBLEDON.

March 25th, 1879.

*From THE SURREY COMET, April 26th, 1879.*

SIR,—Referring to the correspondence that has been going on in your paper for some weeks past, I think it right, on behalf of the company I represent, to state a few facts, with the object of removing the misconception that has got abroad with regard to the quality of the water supplied to London—a misconception which appears to have fostered a conviction in the minds of many that the water is so impure and poisonous as to be totally unfit for human consumption.

As this is a complete delusion, alike unjust and injurious to the public, I trust you will do me the favour to publish the following remarks.

Your correspondent, “An Inhabitant of Wimbledon,” a week or two since, writing in opposition to a letter signed by Mr. Rowell, stated that the most recent Blue-book published on the quality of the water was that of the sixth report of the Rivers Pollution Commission. The fact is correct, as it was published in 1874, whilst that of the Royal Commission, quoted by Mr. Rowell, was published in 1869. The question, however, which was the most authoritative, unbiased, and trustworthy inquiry may be inferred from a knowledge of the composition of each Commission, and other facts which I shall presently state.

The Royal Commission of 1866, whose report was published in 1869, was composed of the following gentlemen:—The Duke of Richmond, Sir John Thwaites (then chairman of the Metropolitan Board of Works), Colonel Harness, R.E., Alderman B. S. Phillips (City of London), T. E. Harrison, Esq. (past president of the Institution of Civil Engineers), and the eminent geologist, Joseph Prestwich, Esq.

The Royal Commission of 1868, whose sixth report was published in 1874, consisted of three members only—Sir William Denison, C.B., Dr. Frankland, and John Chalmers Morton, Esq. The first-named gentleman, however, died before

the issue of the sixth report, which is signed only by Dr. Frankland and Mr. Morton.

As this report is almost chemical throughout, there can be no doubt whatever that it is virtually the report of Dr. Frankland only, who is known to hold very extreme opinions on the subject of water, and whose bias is so completely on the side of deep-well water supplies, that nearly all others, as regards London, are by him condemned. In fact, the objections that are continually urged against the London water supply originate, in a very great degree, with Dr. Frankland, whose monthly analyses, published in the Registrar-General's returns, are thereby permitted to go forth with Governmental authority. It becomes highly necessary, therefore, to inform persons who are startled and frightened out of the use of water by sensational modes of describing its ingredients, how far such descriptions are consistent with the opinions of other scientific and well-informed men, who are just as capable as Dr. Frankland of arriving at just and proper conclusions.

Shortly after the appearance of the Report of the Rivers Pollution Commissioners in question, Lord Camperdown became so startled with the statement in it—that the water supplied to London was thoroughly unfit for domestic use—that he wrote to the *Daily Telegraph*, urging that Parliament should at once carry out the recommendations of the report, and prevent the companies spending any more money involving new schemes for filtration, storage, &c., of the present sources of supply. Thereupon, in a contemporary paper appeared a very fair criticism of the report, commencing as follows:—

“The fact that the Rivers Pollution Commissioners have condemned the water supply of the metropolis (excepting certain deep wells in the chalk) is exercising considerable influence on public opinion, and is giving rise to some degree of anxiety and alarm. As discussion is becoming rife on this

subject, it is desirable that the public should be clearly informed as to the actual assertions made, and as to the facts on which those assertions are based." \* \* \* "In the first place, it may be right to repeat that the Royal Commissioners who presented the recent report are Dr. Frankland and Mr. John Chalmers Morton; originally, Sir W. Denison, K.C.B. and R.E., was one of the Commissioners, but death removed this distinguished member of the Commission some time ago. In its chemical and sanitary aspects, the present report may, therefore be looked upon as mainly a report of Dr. Frankland, whose opinion of the metropolitan water supply is pretty clearly expressed from month to month in the returns of the Registrar-General. So far, it will be understood that the ponderous Blue-book lately issued is not, strictly speaking, confirmatory of the views entertained by Dr. Frankland, but simply affords another vehicle for their expression."

The article then proceeds to criticise the report, and to show that it contains exaggerated views and fallacies; in fact, that it is a report, not of a Commission, but of a Commissioner, founded, as regards the opinions expressed, on foregone conclusions.

On the same subject, a letter from Sir Edmund Beckett, Bart., Q.C., appeared in the *Times*, on Monday, 10th January, 1876, from which the following passages are extracted, the remainder referring only to official inquiries which took place previous to that of the Royal Commission of 1866 and report of 1869:—

"If Mr. Bailey Denton and Lord Camperdown had been hearing for a quarter of a century as much scientific evidence about water purity as I have, one of them would be less puzzled, and the other less alarmed, by the late Report of the Rivers Pollution Commission, and its contradiction to that of the Water Supply Commission of 1869. They would then have known that the late Report is what every person of experience

in hearing such evidence could have predicted with certainty from the construction of this Commission.

“As an illustration of what is called scientific certainty, and apparently believed to be so by Lord Camperdown, in these matters, I have heard eminent scientific men assert on their oaths—and they always add that these things are, ‘not opinions, but facts’—that the water of a moderate-sized river receiving the unpurified sewage of half a million of people was perfectly good potable water for a town not many miles below the sewage-supplying places. That is a specimen of what we may call the *impurest* philosopher’s view of water.

“On the other hand is a school which maintains, with equal positiveness, the theory that no length of run (within such distances as we are practically concerned with) purifies sewage by oxidation, but that a particle of sewage, or whatever other learned name they call it, sent into the Thames at Oxford, arrives as a particle of sewage at Hampton, and may poison a man in London. It is true that they do not quite like the proposition reduced to those very bare terms, but they cannot deny, when they are pressed by a little cross examination, that it is the logical consequence of their theory.

“Neither can they assert, when called upon to give some real evidence for their theory, that they have ever traced the smallest degree of illness in London to the drinking of the water now supplied from either the Thames or the Lea; and again, they are obliged to admit that their method of testing for what may be called obsolete sewage is itself the subject of controversy among chemists; yet there is not the least difficulty in finding indisputable evidence of the connection between several diseases and the drinking of *well* water near drains, or the breathing of sewer gas. In other words, the latter are demonstrable facts, and the former is an entirely undemonstrable theory.

“In 1869 came out the report of what is usually called the Duke of Richmond’s Commission on water supply, quoted by Mr. Bailey Denton. The purists were helped before that Commission by several first-rate engineers, with magnificent projects for bringing the most unimpeachable water into London from several remote places. The late Chairman of the Metropolitan Board was on the Commission, and other thoroughly practical men, unbiassed by theories of their own. But the scientific men were heard, and in their proper place—*i.e.*, as *witnesses*, and not as *judges*. You might as well have expected an impartial report from Brunel on the merits of the broad gauge, as from a philosopher with a theory about water.

“There was, also, a still longer inquiry into the doings of the water companies, on a Bill of the Metropolitan Board and the Board of Trade in 1870, which ended in some legislation which seems to have caused nothing but expense to London householders, some of whom had stirred up that agitation; but, throughout that inquiry, I remember no serious attempt being made to impeach the quality of the water; at any rate, it failed if there was.

“The net result of all this is that every Committee and Commission, consisting of persons unbiassed by theories of their own, and, in short, every one except this last, has come to the conclusion that the Thames and the Lea, where now taken, and still more when the respective Acts are enforced, are and will be perfectly wholesome and suitable waters for domestic use, and that there is not the smallest scrap of real evidence to the contrary; for the mere opinions of scientific men are not real evidence in matters which admit of demonstration, though we are obliged to put up with them, and popularly call them evidence, in matters which admit of nothing better.”

Such is the opinion of Sir Edmund Beckett, the Leader of the Parliamentary Bar.

It can, however, be readily shown that many eminent chemists, if not the majority of such authorities, hold views essentially opposed to those of Dr. Frankland. The late Dr. Letheby, for many years analyst for the City of London, annually made a report on the London waters, and that of 1872 was commented on at the time in the *Daily Telegraph*, as follows:—

“Dr. Letheby, in his annual report on the water supply to the City, makes a few remarks intended to reassure those who may have been alarmed by the stories told about the impurity of the fluid which we get from the companies. The Doctor admits the presence of organic matter in the water, but he declares that it had been very small, the amount of ammonia and organic nitrogen not exceeding the hundredth part of a grain per gallon. As for turbidity, that had sometimes been detected in the water supplied by four companies out of the eight, but it was always due to the presence of a very small quantity of clay, in which there was occasionally a trace of vegetable tissue, no doubt caused by the heavy floods of the river. He (Dr. Letheby) appears to think that when the fluid is—all things considered—so pure, it is too bad to have the public mind poisoned by insinuations founded on very insufficient data. Dr. Letheby, in fact, goes so far as to censure two brother authorities, Dr. Frankland and the Registrar-General, for employing ‘sensational’ terms, such as ‘previous sewage contamination,’ and ‘living organisms,’ and he roundly declares that these phrases are *mere figures of speech*, ‘with, perhaps, a rather bold touch of exaggeration.’ There will be a very general inclination to accept Dr. Letheby’s view as correct; for, besides that it is always pleasant to discover we are better off than we had fancied, the general sense of the community was beginning to revolt against the dicta laid down.

“The essential distinction pointed out by Dr. Letheby

between the causes of turbidity has been too much lost sight of, and every foreign ingredient has been looked upon as mere filth. While the Registrar-General has thus been at stated periods making our hair stand on end, and driving distracted householders into the most outrageous eccentricities in search of pure water, it seems to have been forgotten that the companies themselves were slowly but surely improving the water by a most elaborate system of filtration. That they have not yet entirely succeeded is no reason for concealing the fact that they have gone a long way towards success. When we are told that the amount of ammonia and organic nitrogen does not exceed the hundredth part of a grain per gallon, we may fairly decline to be any more frightened out of our wits by official sensationalism."

The above referred to the year 1872, since which time all the water companies have greatly improved their works; the Lambeth Company having removed their intake to Molesey, and constructed large store reservoirs, and also increased their filtering area, which works had entirely prevented the turbidity during floods mentioned in the report of Dr. Letheby above referred to.

Another chemist of eminence, Professor J. Alfred Wanklyn, who is well known in the chemical world as a water analyst, some years since published his researches and practice on the subject, under the title of "Water Analysis," which book has reached the fourth edition. It embraces a very learned discussion on the different methods of analysing water, which the curious in such matters will do well to read; but the gist of the whole is that Mr. Wanklyn differs essentially from Dr. Frankland in his results, roundly charging the latter, by using an erroneous process, of exaggerating the quantity of impurities in the samples of water submitted to him. His words are (p. 163, 4th ed.):—"I have frequently called attention to the

results of 1868, and in this country they are becoming notorious, as having illustrated that the error in the Government water analysis is as large as the total quantity pretended to be measured."

Again, Mr. Wanklyn, in criticising the sixth report of the Rivers Pollution Commission (or Commissioner), says:—"Methods like Frankland and Armstrong's have a tendency to yield results in accordance with the expectation of the analyst rather than with the real composition of the sample."

The passage refers to Dr. Frankland's assertion that, in analysing water, its previous history should be borne in mind, while Mr. Wanklyn, very properly one would suppose, says the water as it exists is all the analyst has to do with.

It may be readily understood that Dr. Frankland's mode of reasoning, if he knows that sewage has once been in water, leads him to *expect* to find it on analysis, and, in his own idea, he succeeds.

Here I may remark, however, with respect to the organic matter discovered in minute quantities in water, that chemistry is powerless to detect whether it is of animal or vegetable origin.

Dr. Frankland (page 5 of the Rivers Pollution Report) admits this, as follows:—"The weight of organic carbon, or carbon contained in the organic matter found in different samples of water, indicates the amount of organic matter with which the water is contaminated, but it does *not* indicate the source, *animal or vegetable*, whence that organic matter was derived." Indeed, there can be little doubt that any increase detected in the organic matter after rain, and during river floods, is entirely of vegetable composition.

To recur, however, to Mr. Wanklyn. Referring again to the said report, he charges Dr. Frankland with actual errors in his analyses, which it will be found, by reference to pp. 166 to 70

of the fourth edition of his book, Dr. Frankland admits. The controversy is too long to follow here, but Mr. Wanklyn concludes it with the following passage :—

“The extreme gravity of this ‘sulphate of quinine episode’ may be judged of when it is considered that these experiments are the only evidence, or semblance of evidence, as yet offered by Dr. Frankland in favour of the validity of the process of water analysis which, in his capacity of Royal Commissioner, he has employed, and employed exclusively, in the very important investigations which the Crown had commissioned him to undertake. His method of water analysis, as is notorious, has met with general condemnation at the hands of chemists ; and, with the sole exception of these experiments on sulphate of quinine, everything that he has published concerning his process has been a demonstration of its utter untrustworthiness and impracticability.”

I must now refer to the opinions of another eminent chemist of the day, who is much engaged in water analysis, Dr. Tidy, Professor of Chemistry at the London Hospital, who succeeded the late Dr. Letheby as analyst to the Society of Medical Officers of Health.

Dr. Tidy reports annually to the latter society on the water supply of London, but last year he published a very complete chemical history of it during the previous 10 years. The book contains most elaborate tables of analysis of the water of all the companies, with other information, for a knowledge of which I again refer the curious in such subjects to the report itself. It is sufficient for me here to quote Dr. Tidy’s opinion of the water, and his concluding paragraph, to show also his opinion of Dr. Frankland with reference to certain assertions of the latter in the Rivers Pollution Report so often alluded to.

His opinion of the quality of the water is as follows :—“As officers of health, we know very well that the water question is

not one that can be settled offhand by even the most refined of analytical processes. There is, of course, the chemical view, and I should, naturally, be the last to undervalue it; but the chemical aspect of the matter can never take the place of the medical. And here, then, I venture to state broadly—and the analyses I now place before you justify me in the assertion—that the water supplied to London, the healthiest city in the world, is as excellent in quality as it is liberal in quantity.” And Dr. Tidy concludes his report as follows:—“In speaking (and speaking justly) in laudatory terms of the water of the Kent Company, and in equally depreciating terms (unjustly, I think) of the water supplied by the other London companies, the two Rivers Pollution Commissioners go on to say: ‘The supply of such water (*i.e.*, the water of the Kent Company) to the metropolis generally would be a priceless boon, and would at once confer upon it absolute immunity from epidemics of cholera’ (Sixth Report, p. 275). We, who know how little is known of the cause of such epidemics, how they come amongst us even when we think our defences most secure, how little able we are to cope with them when they are in our midst, may fairly stand aghast when those who are outside our profession, and have never had to fight with disease, have been rash enough to commit such words as these to paper. The members of that Commission, laying claim, it would seem, almost to prophetic power, or, at any rate, to a knowledge positively superhuman, have drawn what I may venture to designate as a very violent conclusion, for which I think the facts laid before you prove there is not the slightest foundation, and which is, moreover, expressly contradicted by the progress of cholera in other parts of the world, whether supplied with water of this particular description or not.”

Having, as I think, shown that the Sixth Report of the Rivers Pollution Commissioners is valueless as regards the water

analyses, on account not only of the questionable chemical methods employed, but by reason of the peculiar prejudices and biassed opinions of one of the Commissioners, I now return to the Report of the Royal Commission of 1866, which was a real and sterling judicial inquiry into the subject, and before which appeared as witnesses (not as judges) most of the eminent chemists of the day, including Dr. Frankland himself.

The conclusions arrived at, after nearly three years of inquiry, and with all the chemical evidence in view, are very significant of the value put upon such evidence as Dr. Frankland's by the Royal Commissioners, inasmuch as they assert that, "Having carefully considered all the information we have been able to collect, we have no evidence to lead us to believe that the water now (*i.e.*, in 1868) supplied by the companies is not generally good and wholesome."

In contradistinction to this, Dr. Frankland is even now, after 11 years of improvements by the companies, repeatedly asserting his opinion that the waters supplied by the Thames companies are unfit for human consumption.

The public, as a rule, do not read scientific books on this subject, and only get their information from paragraphs in newspapers, which are occasionally very fair and complete criticisms of works or reports appearing from time to time, but are usually only the monthly reprints of Dr. Frankland's reports and opinions, published under the authority of the Registrar-General. These, besides stating statistical facts and chemical analyses, contain remarks couched in sensational language, and embellished with nauseous epithets, which, being repeated 12 times every year, no doubt take possession of the public mind, to the exclusion of truer and fairer reports, which have not the privilege of Government publicity, and are written in becoming language.

Is it fair, is it just, either to the companies or the public?

On the contrary, is it not highly injurious to the latter, that a chemist holding such views should have the exclusive privilege of placing his opinions before the world, through the authoritative medium of the Registrar-General?

One word more with regard to the Report of the Rivers Pollution Commissioners. Inconsistent as it may appear with the conclusions and recommendations of that document, yet, at page 4, will be found the following:—"The microscope has never yet discovered, even in the most polluted drinking water, any germ or organism which is known to be deleterious to human health; but, by showing the presence of living organisms in water, it proves either that the water has not been so efficiently filtered as to remove these organisms, or that it has subsequently become polluted by them, and thus it is indirectly demonstrated that the water has not been treated, preserved, or stored under such conditions as would preclude the access of deleterious germs or organisms."

It will, no doubt, be reassuring to many water consumers, who have almost been frightened out of even tasting that liquid, by the sensational paragraphs in the monthly reports above-alluded to, to read the following extracts from that of the Royal Commission of 1869, bearing in mind, as they do so, that extraordinary and successful efforts have been made by the companies since the date of that Commission, to improve the quality of the water. The conclusions as to the quality of the Thames water, page 120, are as follows:—"That there is no evidence to lead us to believe that the water now supplied by the companies is not generally good and wholesome. That, for drinking purposes, the hardness of the Thames water is quite unobjectionable, and in no way prejudicial to health. The weight of evidence seems in favour of hard water, as more free from certain dangers inherent in soft water, on account of their greater solvent power. That, for cooking, no important objection to the Thames water

has been clearly proved, except as regards the deposit in kitchen boilers, which deposit is easily removed. That, for washing, and for manufacturing purposes generally, soft water is preferable, as more efficient and more economical; but there appears no means of expressing the amount of saving in a money estimate. Looking, however, to the fact that the hardness of the Thames water is moderate in degree, and is still further reduced by boiling; and, considering also that the proportion of the whole metropolitan supply used for manufacturing purposes is exceedingly small, we cannot see that this advantage is of sufficient importance to render it necessary to go to a great distance for soft water. That the artificial softening process does not appear to be applicable to the Thames water on a large scale."

There are a few more conclusions on the subject of filtration, to the effect that it required improvement; but, as I have before stated, during the time which has elapsed since the date of the Report, the companies have done much in the way of improvement. Dr. Frankland himself admits this, see his report on water in the Local Government Board's report for 1876-77, p. 125, wherein he states: "Since the year 1868, when I first instituted these observations, the filtration of the river water has undergone great and continuous improvement."

The Lambeth Company has spent between £200,000 and £300,000 to this end within the last seven years, and I am now constructing new filters and works, at an additional cost of £60,000, which, I believe, will, when finished, enable us to supply water of the highest standard of quality.

In conclusion, it is scarcely worth while to give my own opinion on the subject, as it may possibly be considered that of a partisan; but I can affirm, after 40 years' experience of the water supply of towns, having, also, an acquaintance with most of the larger of such works throughout the country, and having

personally assisted in the designing and construction of a good many of them, that London ranks, at the present time, amongst the very best supplied cities in Europe ; whilst it is also, upon the authority of Dr. Tidy, “ the healthiest city in the world.”

JOHN TAYLOR,

Engineer to the Lambeth Company.

April 23rd, 1879.

*From THE SURREY COMET, May 3rd, 1879.*

SIR,—Mr. John Taylor, the engineer to the Lambeth Water Company, does not even attempt to answer the allegations made in the correspondence to which he refers, respecting the quality of the filtered Thames water, as now supplied by the companies who resort to this river.

The allegations may be shortly summarised as follows:—

1. That the filtered Thames water, as delivered into consumers' dwellings, contains living vegetable and animal organisms, consisting of Infusoriæ, Desmidiæ, Diatomaceæ, and Fungi ; and the organic productions so abound in it that a whole volume might be written illustrative of their natural history. See the report on “ The Microscopical Examination of the Metropolitan Water Supply,” by Dr. Hassall, presented to both Houses of Parliament in 1857, by command of her Majesty, and confirmed by the late Dr. Thompson, Dr. Lankester, Dr. Redfern, and, very recently, by the eminent medical practitioner and microscopist, Dr. Hogg, and others.

2. That the Thames water, at the point where it is taken by the water companies, is necessarily mixed with the sewage of about a million of souls both healthy and diseased that flows more or less directly into the river, as well as with much

other excreta from animals, thus rendering the water unwholesome for domestic supplies, and this more especially in warm seasons when certain fevers and illnesses are prevalent among the inhabitants.

3. That the Thames water is hard, so as to be unpleasant to use for washing, and so as to deposit a fur when boiled.

4. That the temperature of Thames water in summer is as high as 68 to 70 degrees, and often as low in winter as 34 to 35 degrees Fahr. ; thus, in summer, by its warmth, conducing to the vitality and propagation of germs and vegetable and animal organisms and the virus of certain specific diseases, and in winter readily freezing, and so bursting the distributing-pipes of the consumers.

These, some of the more prominent characteristics that distinguish the River Thames water from uncontaminated subterranean spring water, are silently and unavoidably acknowledged by Mr. Taylor ; but, in extenuation, he brings before your readers certain oft-refuted and even obvious fallacies, such as that the Thames water, after flowing a distance along its open bed, covered at places with deposits of mud and filth, and subject to receive more and more contamination from sewage as it approaches the companies' intakes, can become purified by being strained through a stratum of water-logged, coarse-grained sand, necessarily covered on its surface with decomposing organic matters, and be thus freed from urine, organic matter in solution, and living animalcules, with their seeds and eggs, as well as the germs and virus of diseases often known to be disseminated by water mixed with sewage.

In your issue of the 1st of March last, the large number of deaths that were officially recorded in 1854 as the result of drinking the Thames water, distributed by such of the companies as at that time took their supply from the river below Teddington Lock, was pointed out.

In the same issue, it was shown, on the high authority of the Registrar-General (and *not* that of Dr. Frankland), in his weekly return for the week ending July 20th last year (1878), "That the deaths from diarrhoea during the last four weeks were 786 in the district supplied with Thames and Lea waters, whereas the deaths in the districts supplied with water drawn from the chalk by the Kent Company were 19. Out of the same population, the deaths in the former were to the deaths in the latter as 3 to 1."

Notwithstanding this deplorable fact, first publicly pointed out in July, 1878, Mr. Taylor seems to derive comfort, or wishes your readers to do so, from the contents of a letter in the *Times*—written in January, 1876, or two and a half years previously, by Sir Edmund Beckett, Q.C., the leader of the Parliamentary bar, and who, I may add, is the retained advocate of the London water companies, in which letter, in the interest of his clients, he tries to make the public believe that "the Thames and the Lea, where now taken, and still more when certain Acts are enforced, are, and *will be*, perfectly wholesome and suitable waters for domestic use." Such an endeavour only seems to show, as it seemed to me when first made public, that Sir Edmund Beckett had then little or no real knowledge of the subject on which he wrote, or else that he entertained but a mean opinion of the knowledge and intellect of the public whom he undertook to instruct, or of his clients, the directors and officers of the London water companies, whom he undertook to please, and, as it would seem from Mr. Taylor's letter, to satisfy, by fathering statements, now, at least, amply proved to be so mischievous and erroneous.

As the engineer of the Lambeth Company cannot deny that a Blue-book, published in 1874, is a later production than one published in 1869, he appears to endeavour to console himself by telling your readers that, in his opinion, the conclusions of

the noble Duke and the five other gentlemen who composed the Commission in 1866, are more to be relied upon than the more recent conclusions of the three scientific gentlemen who formed the Commission of 1874; for, though it is true that Sir W. Denison, C.B., unfortunately died before the issue of the sixth report and last Blue-book on the domestic water supply of Great Britain, yet it is certain that if Sir W. Denison's life had been spared, he would also have signed this report, as all through the long investigations by the Commission, Sir W. Denison was known to be in complete accord with his colleagues. It would be an invidious undertaking to discuss the merits of the men who composed the two different Commissions, or the manner in which they respectively fulfilled their tasks, and I do not, at any rate now, intend to do so; but Mr. Taylor must be very forgetful when he writes as though Dr. Frankland were the sole or principal advocate of London being supplied with subterranean water from the chalk.

Since 1840, when such a supply was first proposed to a committee of the House of Lords, of which the then Marquis of Westminster was chairman, every independent and official inquiry, by acknowledged competent men, has resulted in recommending that a supply of subterranean water from the chalk should be provided for the metropolis. Thus, in 1851, the Government Commission, consisting of three most eminent men of science, namely, the late Professor Graham, F.R.S., the late Professor Miller, F.R.S., and Professor Hoffman, F.R.S., reported most strongly in favour of a supply of softened subterranean water from the chalk for the metropolis, stating that "The water recommended," *i.e.*, softened chalk water, "appears to approach most closely to the standard of all that is excellent in a town supply, and is worthy of the greatest efforts and grandest works to procure and convey it. But the sources are near at hand, and the water is attainable without

difficulty or great expense. With such a noble application of the chalk-spring water in view, as the supply of the metropolis, it would be a desecration to permit that water to be wasted on other uses, and most impolitic to allow the possession of it to pass into private hands. It is our deliberate opinion, which we would enforce in the strongest terms, that the much-desired and most necessary improvement in quality of the London water, is associated with these sources of supply, and will depend upon their proper application to the uses of the public."

Again, in 1856, the late Dr. R. D. Thomson, F.R.S., and Dr. Hassall reported strongly in favour of a supply of subterranean water from the chalk, and against the use of River Thames water. The inquiry in 1874, into the quality of the filtered water then supplied from the Thames to Richmond, the particulars of which appeared in your journal at the time, ended in the Thames water being condemned, and a supply from the chalk resorted to; yet it would seem as though the engineer of the Lambeth Company had never heard of these things, or, if he had, must have forgotten them, otherwise how could he finish his letter by stating that "London ranks, at the present time, among the best supplied cities in Europe," or, in the face of the recent Registrar-General's report, showing the increase of deaths from diarrhoea in the districts supplied by the Thames companies, quote the unsupported words of Dr. Tidy to the purport that "London was the healthiest city in the world;" for, even if the words were literally true, what has this to with the supply of *Thames* water? London, and the district around it supplied by the water companies, in round numbers contain four million inhabitants, of which one and a quarter million are served by the New River and Kent Companies, that derive their supplies the one wholly, the other for the most part, from the chalk strata.

The Registrar-General has shown that the deaths from

diarrhœa last June and July were as three to one in the districts supplied with water from the Thames and the Lea, as compared with the districts supplied from the chalk by the Kent Company. It is not, therefore, the proportion of deaths in all London that concerns the inhabitants of Wimbledon, but the illness and deaths that occur in that portion of it supplied by Thames water.

I am, sir, your obedient servant,

AN INHABITANT OF WIMBLEDON.

Wimbledon, April 30th, 1879.

*From THE SURREY COMET, May 17th, 1879.*

SIR,—I scarcely consider it necessary to reply to irresponsible allegations, made by an anonymous correspondent, on the authority of water reports, written a quarter of a century ago by learned doctors now dead and gone, because the changes that have been effected during this interval, both in the sources of supply and the filtration of the Thames water, have entirely altered its character. However, as your Wimbledon correspondent makes some very exaggerated remarks, I think it right, on public grounds, that they should not go uncontradicted.

1. With regard to the views of the departed gentlemen above referred to being confirmed by “the eminent microscopist, Dr. Hogg,” with whom, I regret to say, I am unacquainted, I beg to deny, and affirm it to be entirely untrue, that any such creatures or growths, with the alarming list of names paraded by your correspondent, can be found in the water supplied by the Thames companies. A gallon of stagnant water from a foul cistern, condensed by evaporation to a drop, may show such

things when magnified 100,000 times, but I deny that the water, as distributed by the companies, does. The water supplied 25 years since was, no doubt, at times very turbid, and the sediment of turbid matter, kept standing for a time, would probably be found to contain living organisms. I have already stated, in my former letter, Dr. Frankland's assertion, that the microscope has never discovered anything deleterious to human health in such sediment, and it is simply absurd for any one to infer that, because a drop of stagnant water contains such matter, the whole of the Thames water supplied to London is unfit for use.

2. It is entirely untrue that the water, where taken by the Thames companies, is mixed with the sewage of a "million of souls." The entire population of the towns and villages above this part of the river does not exceed three hundred thousand, and it is now a fact that the whole of the sewage of such towns and places is diverted from the river and purified, either by irrigation or otherwise, before the effluent water returns into the Thames. The evidence of what Dr. Frankland calls "previous sewage contamination" is far stronger as regards the deep-well water of the chalk than of the Thames water. But he tries to explain this away by stating that it has become innocuous.

3. The question of soft water *versus* hard has been discussed for years; each has its advocates, but the balance of evidence is entirely in favour of moderately hard water, and the report of the Royal Commission of 1869 confirms this. I have no doubt nine people out of ten prefer hard water for drinking.

4. The temperature question is scarcely worth discussing. No doubt the water from deep wells is warmer in winter and colder in summer when first pumped, but the difference becomes infinitesimal by the time it reaches the consumers.

There is no use in your correspondent trying to disparage

the filtration of the water. The Government, in 1871, passed an Act making it penal for any company to serve unfiltered water, and appointed a water examiner, Col. Bolton, R.E., to see to this; and it is quite idle for anyone, for his own private benefit or inclination, to describe in disgusting language things that exist only in his own imagination. The worst water ever supplied by the Lambeth Company last year (and that on one occasion only), according to Dr. Frankland, contained 1 part of organic elements (carbon and nitrogen) to 285,714 parts of the water; the average was 1 part in 383,141. The worst did not show a quarter of a grain in a gallon of water, a gallon containing 70,000 grains. This patent fact is the best answer to all the allegations of your correspondent.

Your correspondent wrote a little too soon, when insinuating a doubt as to Dr. Tidy's statement that London was the healthiest city in the world, as we now have it on the authority of the Registrar-General himself, in the annual summary of births, deaths, &c., in London, for 1878, just published.

Sir Edmund Beckett wrote to the *Times*, as referred to in my last letter, not as the counsel for the water companies (although it is true he is generally retained by them), but to show the fallacy of trusting to the opinion of the one, or even two, gentlemen who composed the Rivers Pollution Commission, and the danger of alarming the public on *ex-parte* statements. It is a pity your correspondent cannot be submitted to a little cross-examination by Sir Edmund Beckett, for the benefit of your readers.

The fact is, your correspondent is himself an advocate—that is, of chalk water—and, in order to promote his own views, thinks it necessary to abuse river waters. Much may be said in favour of the former, and I have no particular objection to urge against it. But, admitting the chalk water to be good, is that a reason why no other water is fit for use? I fear your

correspondent secretly feels that the arguments and opinions cited in my last letter were too strong for his case, and that he suffers a little irritation and disappointment from the fact that the present water supply is so good, as all impartial authorities agree that it is.

Yours, &c.,

JOHN TAYLOR,

Engineer to the Lambeth Waterworks Company.

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*From THE SURREY COMET, May 24th, 1879.*

SIR,—It seems that the engineer to the Lambeth Water Company has been so closely occupied with the onerous duty of keeping the sixty thousand domiciles in his district supplied with Thames water, and in extending this supply to new dwellings so rapidly springing up in its suburbs, that he has been unable to pay much attention to the *quality* of the supply, or he could not have made the statement that appeared in your last issue.

1. As to the animalcules found in filtered Thames water, taken direct from the pipes of the companies for the supply of the consumers:—

I have before me particulars of the microscopical examination made by the late Dr. Lankester, F.R.S., of Dr. Redfern, of the late Dr. Hassall, and of Mr. Jabez Hogg and others as to this.

Dr. Lankester found in the filtered Thames water supplied from the pipes of the Lambeth Company, taken above Teddington Lock, as many as 38 different *species* of living organisms, consisting of animals, plants, and diatomaceæ, and large quantities of each species.

Dr. Redfern testifies that, "in a single fair average specimen of half a gallon of Thames Ditton water (just as supplied into consumers' dwellings), were found 29 different species of living beings; but, during the examination of seven specimens, taken at different periods, no fewer than 60 distinct *species* were found. The 29 species in the half gallon consisted of 19 *species* of animals, seven of plants, three of diatoma cœæ, and considerable quantities of many of them."

Dr. Hassall, reporting in 1854 to the then President of the General Board of Health, when all the Thames companies were taking their supplies from above Teddington Lock, and who examined specimens of water taken direct from consumers' pipes in the cold month of December, after confirming Dr. Lankester and Dr. Redfern, says: "It follows that the metropolis is still supplied with water containing considerable numbers of living vegetable and animal productions, and which are not present in the purer waters; as, for example, that supplied (from the chalk) by the Plumstead, Woolwich, and Charlton Company. . . . It should be recollected, however, that the present examinations have been made in the midst of winter; that is, at the period most *unfavourable* to the development of animal and vegetable life."

Mr. Jabez Hogg testifies, in a paper read before the Society of Arts, May 12th, 1875, that "almost every gallon of river water distributed to London contains a quantity of spores, or ova, of vegetable organisms." And then goes on to say: "I have more particularly dwelt upon the Thames, because, during three months of last year, I made repeated microscopical examinations of the water drawn from the mains and taken from cisterns of the Southwark and Vauxhall Water Company, and in every instance I found the specimens coloured with a considerable dirty sediment, and numbers of organisms. The latter consisted of living and decaying vegetable bodies, as amœbæ,

actinophyssol, cercomonas, rotifers, paramœcium, larvæ of filariæ, and fully-developed filariæ, resembling the much-dreaded trichiniæ . . . . also myriads of the terrible *bacteria*. The latter are looked upon by Mr. Simon as the cause of filth-fever, while the spirillum is a fungus supposed to produce relapsing fever." The results of Mr. Jabez Hogg's examinations have been confirmed by Dr. Thudichum and others.

2. As to the number of the population residing on the drainage-ground of the Thames, above the intakes of the water companies at Hampton:—

The engineer of the Lambeth Company is very imperfectly acquainted with particulars of the population residing in the numerous farms, villages, towns, and cities located upon the two and a half million of acres that constitute the area draining into the Thames at Hampton, near where the water companies take their supply, or he would not have ventured to put down the population residing in this area at only 300,000. I have had occasion to accurately ascertain the number of souls residing on this area, and I found the numbers at the present time turn out to be something over one million.

As to the assertion that the sewage-water of the numerous towns, villages, farms, and places situated on the drainage-ground of the Thames and its tributaries is purified before being returned into the Thames, your readers, Mr. Editor, will put what value they like on this assertion; for myself, I should rather not have river water mixed with such clarified sewage served to me for domestic use. It is *present* and not *previous* sewage contamination that we are now concerned about.

3. As to hard and soft water. Except for flushing closets, nine-tenths of the water used in a household is required for personal ablution, baths, washing, scrubbing floors or walls, or for boiling; for all these purposes, soft, and not hard water is

necessary, and certainly hard water mixed with sewage, even though clarified, would commend itself to few, even for drinking, and to *none* for washing purposes.

4. Is the difference between the temperature of spring water and river water infinitesimally small as delivered from the pipes into the consumers' houses?

In the annual summary of the Registrar-General for 1878, it is stated, p. 39: "That the temperature of the Thames companies' water, as delivered from the mains, was found in the past January and December to be 39·7 degrees Fahr., while the deep-well water delivered by the Kent Company showed a minimum temperature of 44·9 degrees. The temperature of the Thames water in July, 68·5 degrees, while the deep-well water of the Kent Company was a maximum of 56·1 degrees. . . . Thus it will be seen that the temperature of the river water ranged through no less than 29·0 degrees Fahr., whilst that of the deep well waters varied through only 11·2 degrees." River Thames water, as we have before seen, when above 60 degrees in summer, fosters diarrhoea, and when cold, as in winter, is soon frozen, thus bursting the lead service-pipes; the alternate heat and cold of Thames water will hardly, therefore, seem so infinitesimal to the consumers, as it seems to be to the engineer and directors of the Lambeth Company.

As to filtration. No engineer would contend that urine and water will not pass together through a water company's filter, and it seems to me that no patent fact can make Thames water agreeable, or even wholesome, when this is borne in mind.

As to London being the healthiest city in the world What the Registrar-General really shows and says in his annual summary of births and deaths in London is as follows (see page 7):—"That the rate of mortality in 1878 in inner London was 23·5 per 1,000. In the outer ring (a large portion of which is supplied by chalk water), 16·9; or, in greater

London (an average of inner London and the outer ring), 22·3." At page 8, the Registrar-General shows "That the mortality in 1878 of Dover was only 16·2 per 1,000; Rochester and Chatham, 18·1; Maidstone, 18·4; Hastings, 18·9; Cheltenham, 19·4; Chester, 19·7; Barrow-in-Furness, 18·6; Portsmouth, 19·7; Brighton, 20·2." These figures certainly do not bear out the statement imputed to Dr. Tidy; for 22·3 per 1,000, the death-rate in greater London, or 23·5, the rate in inner London, is certainly not less than 16·2, the death-rate of Dover—the inhabitants of which, by the bye, are supplied with subterranean water from the chalk—or of the above-named places.

Mr. John Taylor playfully remarks:—"It is a pity your correspondent cannot be submitted to a little cross-examination by Sir Edmund Beckett." I am of opinion that Sir Edmund Beckett is by far too astute and practised a counsel to enter upon such a Quixotic enterprise. Sir Edmund Beckett knows too well that his fees are earned by keeping his clients out of mischief, and not by running them into mischief.

I am, sir, yours obediently,

AN INHABITANT OF WIMBLEDON.

Wimbledon, May 21st, 1879.

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*From THE SURREY COMET, May 31st, 1879.*

SIR,—My object in first writing to you on this subject was to inform the public that the correspondents, who see fit to disparage the water companies and the water they distribute, received their inspiration chiefly from the views which a gentleman, entertaining adverse opinions, has the almost exclusive

privilege of publishing monthly, with *quasi* Government authority; and to show that numerous other and equally high authorities held views of an entirely different character. Such being my object, it would have been simply absurd for me to have quoted adverse opinions, when my very object was to show that the question is one of controversy, and that the balance of scientific evidence goes to contradict the views of such people as your Wimbledon correspondent, and to show that the water abstracted from the Thames and distributed by the companies is "good and wholesome." Captain Bucknill's assertion, therefore, that I have ransacked reports for years past, and quoted such portions as are favourable to my cause, and have glided past the most important, becomes deprived of all point, since my very object was to put authority against authority, and to show the weakness of the water-traducers' case and the strength of my own. It is not too much for Captain Bucknill to ask me to answer his question, which I do as follows:—

1. Waters contaminated by sewage, such as that of surface wells, in and near populous places, which all local sanitary authorities condemn, tend, no doubt, to produce certain epidemic diseases. The Lambeth Company are constantly being asked by such authorities to extend their pipes and supply water in lieu of such well waters.

2. The population of the entire Thames Valley above Hampton may possibly be half a million, but, as I stated in my last letter, the population of the towns and places draining to the Thames and its tributaries does not exceed 300,000. It is ridiculous to include in this category all the farms and other isolated buildings and small hamlets and places miles away from the Thames.

- 3 and 4. Where there is a lavish water supply, as in London, the sewage is about equal to such supply, namely, about 30 gallons per head per day, which, on 300,000 popu-

lation, gives nine million gallons per day, which is now all diverted from the Thames under the authority of the Thames Conservators, the effluent water flowing into the Thames and tributaries of the standard of purity laid down by that authority.

5. The dry-weather flow of the Thames at Hampton is seldom so low as 400 million gallons.

6 and 7. The germ theory of disease is the fashionable idea with the present generation of doctors, and, no doubt, serves very well their views in accounting for diseases; but, after all, it is only a theory, as no germ has ever yet been discovered by the most powerful microscopical examination. The so-called germs of disease are just as likely to exist in the atmosphere as in the water; nay more so, seeing that all our residences are in intimate connection with the sewers, and most of them imperfectly protected from the inflow of poisonous gases therefrom; and it seems to me that it would be just as logical to decline to breathe as to drink on this account.

8 and 9. The Thames water is, no doubt, transparent and clear in dry summer weather, when at its lowest flow; but, to attribute any increase of disease in the districts supplied by the Thames water companies in the summer to this cause alone, while ignoring all the other palpable causes for increased disease in hot weather, seems to me to be reasoning of a very feeble character.

10. The Lambeth Water Company, under my recommendation, are boring to ascertain the depth to the chalk, and the probability of obtaining an auxiliary supply of water from it. This action is not because we entertain the slightest doubt upon the purity of the Thames water, but for economical and other reasons, which I need not explain.

As regards "An Inhabitant of Wimbledon," he only goes back again to the defunct authorities of 25 years since, highly

respectable and worthy as they no doubt were, but I have shown that the water question is entirely changed since that time. The intakes are changed upon Parliamentary authority, the storage and filtration improved from the endeavours of the companies to provide purer water, the river cleansed by the action of the Conservators, and the quality of the water immensely improved as admitted even by Dr. Frankland.

What is the use of quoting the results of Mr. Jabez Hogg's examination of water drawn from cisterns in the Southwark and Vauxhall Company's district, in which he is stated to have discovered creatures with unpronounceable names? I have already stated that stagnant water, such as exists in thousands of dirty cisterns in the metropolis, when condensed by evaporation, will be found to contain most objectionable matter; but this does not arise from the want of purity of the water in the companies' mains, but from the accumulated dirt and dust of years (in some cases) in the house cisterns.

We are continually having complaints that the water we supply is in a filthy condition, and, in a case of such complaint investigated last week, the cistern in the kitchen was found to contain shovels-full of black beetles. Would your correspondent affirm that these living organisms came out of the company's mains?

I am free to admit that the great *desideratum* at the present day is the introduction of what is called "constant supply," so that the water may be got pure from the mains. The Lambeth Company are changing to this system as rapidly as circumstances will admit; but, perhaps, your correspondents will be surprised to hear that the greatest obstacle to it exists amongst the consumers themselves, as the following passage from our directors' half-yearly report will show:—"Many of the owners or occupiers have had to be forced into putting their fittings into a proper state for this service, which is, in some cases, regarded as

the infliction of a hardship, rather than the bestowal of a boon."

Your Wimbledon correspondent attempts to throw doubt on Dr. Tidy's assertion, that London is one of the healthiest cities in the world, by giving the death-rates from the Registrar-General's report of other small towns in the kingdom in which the death-rate is lower, and cites such places as Dover, Rochester, Chatham, Maidstone, &c. I ask, can any of these places be classed amongst the cities of the world, or are they at all comparable with London? He might as well have mentioned Herne Bay, which is remarkable as having a death-rate of only some twelve per thousand. I would ask him, in reply, how it is that Glasgow, with the much-vaunted pure water supply from Loch Katrine, has a death-rate higher than that of London; and also how it comes about that Manchester, Liverpool, Birmingham, Newcastle, and Dublin, all have death-rates higher than London, yet with unexceptionable water supplies?

I am accused of "special pleading." All I want is fair play on a subject of great public importance, and all I have aimed at is to show that a false impression has been fostered by the views and crotchets disseminated almost exclusively by one class of opinions, and which has, to a great extent, got possession of the public mind, to the exclusion of common sense.

JOHN TAYLOR,

Engineer to the Lambeth Company.

28th May.

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*From THE SURREY COMET, June 14th, 1879.*

SIR,—The engineer to the Lambeth Water Company, towards the end of his letter in your issue of the 31st ult., asks

“How is it that Glasgow, with the much-vaunted water supply from Loch Katrine, has a death-rate higher than that of London?” and also “How it comes about that Manchester, Liverpool, Birmingham, Newcastle, and Dublin all have death-rates higher than London, yet with unexceptionable water supplies?” Have all these towns “unexceptionable water supplies?”

The four cities of Glasgow, Manchester, Newcastle, and Dublin are all supplied with surface water, impounded in open, uncovered lakes, either natural or artificial. Liverpool also derives by far the greatest portion of its supply from surface water, also impounded in artificial lakes. These lakes have been formed or enlarged by placing earthen embankments or dams across valleys, that serve to store perennial and flood waters, the insides and bottoms being composed of the soil and land in its natural state, even the grass and shrubs being left on the surface to decay and be covered with water when the lakes are full, and to be exposed to sun and air when empty. Leaves and blossoms, droppings of animals, and other impurities, are washed down into the lakes by means of streams and floods, and in this way the bottoms and sides, which are never cleansed, in the course of years become thickly covered in many parts with organic matter, that sooner or later decays and continues to form more and more offensive mud. Living organisms, finding congenial *habitat* in the mud and water, rapidly increase and multiply, and diffuse themselves everywhere throughout the mass of the water, more especially in the warm seasons of the year, and, accordingly, when such lake water is submitted to microscopical examinations by a skilled medical practitioner, intimately acquainted with the names, forms, and habits of the minute organisms, vegetable and animal, that pervade impure waters, the waters, even after filtration, or as supplied into consumers' dwellings, owing to the quantity and quality

of its organic contents, living and dead, is shown to be quite unsuited for drinking. Drawn direct from the mains, such water is found to contain entomostraca (or water fleas), some visible to the naked eye, paramœcium, amœbæ, cercomonas, protococcus pluvialis, confervæ, desmids, fungi, and the *débris* of mosses and decaying vegetable matters.

With respect to Birmingham, the greater portion of its supply is subterranean water, obtained from the new red sandstone, but, unfortunately, the water, instead of being supplied direct from wells into consumers' dwellings, is first raised into large open reservoirs, the bottoms and sides of which are formed, for the most part, of bare earth. In consequence of being thus open, and exposed to light and sun, great contamination takes place from spores, conveyed into the water by air and rain, which soon grow and form masses of vegetation, which float for a time, soon decay, become corrupt, and get mixed with and partially dissolved in the water, give forth an offensive, marshy odour, and become the *habitat* of animalcules and other organisms that live, propagate, and die, become diffused throughout the water, and are thus conveyed, through pipes, to the consumers. It is *not*, therefore, correct to assume that any one of these towns is in possession of "unexceptionable water supplies;" unless, indeed, the important quality of wholesomeness is to be considered of no account.

Let us now turn to other portions of this letter, in considering which it would be well, as men of the world, to bear in mind that the London water companies collectively have expended about twelve millions in the construction of their works; remembering this fact, is it any wonder that "authority," or "authorities," can be found to exercise their ingenuity in attempting to make people believe that the river water of their clients—mixed though it may be with excrement of men and animals—is wholesome?

Water, whether derived from wells, or whether derived from

rivers or lakes, when mixed with unwholesome organic matter, living or dead, or the excrement of diseased men and animals, is all equally bad, and may readily become the means of propagating disease, and thus causing premature death. It must, however, be remembered that it is impossible to prevent much organic and much faecal matter from getting mixed with river, stream, or surface water; but that, on the other hand, by the exercise of proper care, the normal purity of well, and especially of *deep*-well water, may be readily maintained. Thus water, derived from the deep recesses of uncontaminated chalk strata, is found to be quite free from unwholesome matter, and, thus pure, could be readily obtained and cheaply supplied to all London and its suburbs.

Why, in Mr. Taylor's opinion, it is ridiculous to include in the number of the population draining into the river Thames and its tributaries above Hampton those residing in farms or isolated buildings and hamlets situated on its drainage-ground, he does not even attempt to show? The faecal and other impure matters draining from these small places as surely reach, and ultimately mingle with, the river water—more especially after heavy rains—as that of larger places situated more closely to the intakes of the water companies, as Windsor and others.

As to the statement that the nine million gallons of sewage water—that Mr. Taylor himself estimates to be discharged into the river above Hampton—is now diverted from the Thames, this is a pure mistake, for the whole of this sewage water ultimately finds its way into the river. No doubt, before reaching the river, some of the sewage water has been treated by one process, and some by another, for the purpose of deodorization; but those who have studied the subject know very well that no existing process will remove the urine, or fail to leave much unwholesome organic matter in the effluent

mixture. Although portions of solid matter may be separated from feeders and rivers, yet impure liquid matter cannot be so separated, and a river thus *necessarily* becomes, to a large extent, the sewer of the district through which it flows.

The statement of your correspondent, that "no germ has ever yet been discovered by the most powerful microscopical examination" (known to produce disease), is simply loud talk. To give one instance out of many, there is a fungus that lives and propagates in impure water, called "*Bacteria*," twenty-four thousand of which will only cover a square inch. One of these little fungi looks like a rod, and is called a germ. Though so small, they grow more rapidly than any other kind of plant. One little germ, when it gets the food it likes, will produce several hundreds in a minute. Mr. Jabez Hogg says, "these atoms (*baeteria*) are the active agents in putrefactive changes; and, having gained access to certain internal organs of the human body, they proceed to leaven the whole mass of blood. A drop of putrid water, Ehrenberg calculates, will contain as many *baeteria* as there are human beings on the face of the globe! What, then, must be the size of the ova or germs of these organisms? And what mode of filtration *can* we devise to sift them out of water that contains them? Is it possible to do so? And what does the clumsy process adopted by water companies effect in this way?"

When an ample supply, at a cheap rate, of good softened spring water, free from all microscopic or other organic matter, living or dead, and well fitted in all respects for drinking, washing, and other domestic uses, can be so readily procured for the supply of Wimbledon, and of all London, why should my neighbours and I be prevented from having such a supply served to us?

Why does Mr. Taylor deliberately, and wantonly as it appears to me, so misquote, as to endeavour to lead your readers

to believe that Mr. Jabez Hogg only found the organisms he describes in water drawn from *cisterns* supplied with filtered Thames water, when Mr. Hogg expressly states that “he made repeated microscopical examinations of the water *from the mains*, and taken from the cisterns of the company.”

I do not propose to ask you, Mr. Editor, to extend this discussion into the comparative merits of constant and intermittent supply; it should be remembered, however, that it is the London water companies who still, for the most part, insist as for thirty years past, and more, they have all heretofore insisted—that every newly-erected house and dwelling shall be supplied with cisterns, and served upon the intermittent system. Is it wonderful, then, when the occupier or landlord of a house has once been obliged to provide fittings and cisterns for an intermittent supply, that he does not care to put himself to such inconvenience and such further expense *as the water companies demand*, to enable him successfully to obtain a constant supply of Thames water.

Those who have attentively read and considered this discussion must, I feel sure, be convinced by the statements of the engineer to the Lambeth Water Company, that it would be utterly vain to expect any voluntary improvement in the source or the quality of the water supplied by the existing London companies while they are permitted to maintain the close monopoly they have somehow contrived to bring interest to maintain, and have so much abused for the last thirty years and more. It is evident that any decided improvement—whether as respects quantity, quality, or cost—can only be obtained by well-directed exertions of the consumers themselves.

The Registrar-General has done his duty. As before mentioned, this impartial authority has pointed out, in his weekly report of July 20th last year, that “The deaths from diarrhœa are

differently distributed in the fields of the water companies; thus, the last four weeks were 786 in the district supplied by the Thames and Lea waters, whereas, in the district supplied by the Kent Company, there were only 19 out of the same population; the deaths in the former were to the deaths in the latter as three to one."

Surely this appalling fact would fully justify the Government Commission, which, in 1874, recommended "That the Thames should, as early as possible, be abandoned as a source of water for domestic use."

To effect this desirable object, the diffusion of sound information is the one thing necessary; for, with competent knowledge, it is hardly to be credited that the consumers would continue to submit to the existing companies continuing to monopolise the supply of water to London, and thus effectually prevent us obtaining this indispensable necessary of life wholesome and good in quality, ample in quantity, and at a fair price.

I am, sir, your obedient servant,

AN INHABITANT OF WIMBLEDON.

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*From THE SURREY COMET, June 28th, 1879.*

SIR,—I am fully aware of the hopelessness of an attempt to convince a man against his will; and, as I fear the conclusive arguments and facts brought forward by your correspondent, "An Inhabitant of Wimbledon," have failed to satisfy the advocate of the Lambeth Water Company of the necessity of a pure water supply, I will not undertake the hopeless task. I

gather from Mr. Taylor's letters, which have appeared in your columns, that he entirely rejects the evidence of the microscope in this matter; that he disbelieves in the existence of the minuter and meaner things revealed by its aid; especially so, should the instrument detect the presence of organic life in the water of the Lambeth Company. He rather seems to think that only weak-minded people resort to such toys as microscopes; and then they see the motes floating in their own eyes, which they delude into believing are entomostracæ and bacteria; in short, that such creatures exist in the imagination of scientific noodles. He is also, no doubt, prepared to maintain that dirty water—that is, water contaminated by the excreta of thousands of human beings and animals—is far more likely to promote the health of those who partake of it than water drawn from the purest natural spring. But, if Mr. Taylor refuses to believe in the existence of microscopic life in the Lambeth water, he may, perhaps, be open to conviction if animals of a larger and, many people will say, of a more repugnant kind are brought to his notice. With your permission, I beg to place before him a fact that transpired in the course of last week.

The editor of the *Daily News* informs his readers that an interesting animal, an eel eight inches long and half an inch in diameter, was then lying before him. It had been captured, after some sport, in the valve of the waste-pipe of a tank, used to feed the locomotive engines at one of the railway stations. These tanks are on the constant supply system, and the mains carrying the supply are the same that feed creatures we call men and women. It is, therefore, rather an uncomfortable thing to find we are in danger of swallowing live eels with our water. But it is quite possible that Mr. Taylor will see no more harm in eels than did the learned counsel who defended the water company at the Richmond inquiry some four years ago. The facetious speech of the learned gentleman was reported in

your columns at the time, and his remarks on the presence of the grosser animal life in house water-eisterns are well worth reproducing. He said:—"What evidencee was there of the defective quality of the water? Why, simply this. There was a fish brought, and a young alligator (a playful description of an eel) was produced; but these things did get into eisterns sometimes, and the liveliness of the animals spoke in favour of the quality of the water, rather than otherwise. Whether the fishes got into the eisterns through the company's pipes, or whether little 'Jackey' put them in, he could not say; but, at all events, there was nothing serious in having fish in your eistern; and, if he found one in his, he should rather be amused than otherwise, and should give it to his little grandson to play with." So you see, sir, there is no accounting for tastes, even in the matter of the water we drink; and, perhaps, Mr. Taylor will see no objection to the poison of typhoid fever or cholera being conveyed into house-eisterns, and he may feel that he is only doing a good turn for my brethren of the medical profession.

It is not, however, that the majority of people so much object to eels in themselves; but, since we pay a very large sum of money to the water companies to supply us with pure and wholesome water, it is only reasonable to expect them to respect the tastes of those amongst their customers who prefer, as I must confess I do, to take their drinking water without "body." Perhaps the persons connected with water companies, and who are responsible for sending eels to those who would rather not have them, will say "there is no reckoning with eels." Nevertheless, a line must be drawn somewhere; and, if water companies do not care to be bothered about microscopic creatures and cholera poison, surely they will not think people frivolous or fastidious who draw the line at "eels and fishes."

It is an undeniable fact, as Mr. Yorke said in the House of Commons last week, "That our choice was between 'thick

turtle' and 'clear turtle,' for there are many deleterious matters in some London waters which no filtering could or would remove."

I remain, sir, your most obedient servant,  
JABEZ HOGG.

1, Bedford-square, June 18th, 1879.

